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Second Look Procedure for Large Burn Defect by Banana Peel Pericranial Flap Based on One Artery

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SUMMARY

Introduction Scalp and calvarial defects may result from trauma, thermal or electrical burns, resection of benign or malignant tumors, infections or radionecrosis. Reconstruction of large scalp defects is a demanding procedure. The reconstructive "ladder" are applicable to scalp and calvarial defects reconstruction.

Case Outline A 68-year-old female was admitted to our clinic due to the nine-day old scalp burn wound, incurred under unclear circumstances. Third degree burn wound affected the left frontal-parietal, temporal and part of the occipital region with carbonification of the whole left ear lobe. The treatment was carried out in two stages. Radical full thickness necrectomy of the scalp was performed, the defect margins were curetted to the active bleeding, and the ear lobe was amputated. The defect sized 23 x 15 cm was reconstructed using the "banana peel" transposition galea-cutaneous flap from the remainder of the scalp, which was based only on the right occipital artery. Two months after the surgery the appearance was satisfactory, and all wounds were healed.

Conclusion Designing of large-scale flaps is very hazardous, especially in elderly people. Scalp reconstruction based on one artery has to be planned in detail and performed when the possibility of complication is reduced to minimum. Our case report underlines possible reconstruction as delayed procedure even with the exposed bone (second look procedure), as well as the reconstruction of half scalp with the local flap based on one pericranial artery.

Keywords: scalp defect; delayed reconstruction; third degree burn; occipital artery; pericranial flap

INTRODUCTION

Scalp and calvarial defects may result from trauma, thermal or electrical burns, resection of benign or malignant tumors, infections or radionecrosis. The reconstructive "ladder" is applicable to reconstruction of scalp and calvarial defects. In the ascending order of complexity, the ways of scalp reconstruction include primary closure, skin grafts (partial-thickness defects), local flaps with or without tissue expansion (full-thickness scalp wounds), occasionally regional flaps, and free flaps [1-4].

There are a number of local flap techniques: single or multiple, and with or without skin grafting to close the donor defects. Single flaps in turn comprise rotation, advancement, transposition, bipedicular flaps, VY advancement, rhomboidal flaps, etc. Multiple flaps include the triple-flap technique described by Orticochea, triple rotation (pinwheel) flap, double rotation flap, triple rhomboid flap, etc. [5-9]. The correct design of such flaps implies preservation of the original hairline, acceptable redirection of the hair follicles, incorporation of large vascular pedicles, and wound closure without excessive tension [10, 11].

Knowledge of scalp anatomy is essential in planning of reconstructions. The skin layers of the scalp are easy to remember using well-known mnemonic SCALP: (1) skin, (2) subcutaneous fat, (3) galea aponeurotica, (4) loose areolar tissue, and (5) pericranium. The skin in this region is the thickest in the body (3 to 8 mm). It is resistant, very scantily elastic, and covered with hair, which in most patients makes esthetically pleasing reconstruction a challenge. The galea aponeurotica continues with the frontal muscle anteriorly and the occipital muscle posteriorly. Laterally, the galea aponeurotica is continuous with the temporoparietal fascia. The pericranium fuses with the deep temporal fascia laterally [7]. In addition, the scalp as a whole is inelastic, with the galea aponeurotica being poorly elastic and the pericranium being nearly non-distensible. The parietal regions, located over the temporoparietal fascia, are the areas of the scalp with the greatest mobility. A well-vascularized subcutaneous layer lies superficial to the galea aponeurotica. A robust choke vessel system allows relatively long local flaps to survive without distal necrosis. The vascular supply of the scalp consists of the paired supratrochlear, supraorbital, superficial temporal, posterior auricular and occipital arteries and their accompanying veins. The supratrochlear and supraorbital arteries arise from the ophthalmic artery, which is the

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first branch of the internal carotid artery. The remainder of the arterial vasculature supplying the scalp originates from the external carotid artery [1, 12].

This article reports a case of thermal burn causing a large-full-thickness scalp defect. The patient had a third degree burn injury on the left half of the head and left ear.

CASE REPORT

A 68-year-old female was admitted to the Clinic for Plastic and Reconstructive Surgery Clinical Center Niš due to the 9-day old scalp burn wound; she had been injured under unclear circumstances. She was found leaning against the wood stove. Until the admission, she was not treated by medical personnel. Third degree burn wound affected the left frontal-parietal, temporal and part of the occipital region with carbonification of the whole left ear. The percentage of burned skin was 2% of body surface area (Figure 1). The scalp burn was heavily infected and suppurating with moderate facial and left neck swelling. The patient was conscious on admission. Accordingly, the patient's general condition was scored as grade II by American Society of Anesthesiology (ASA score). The treatment was carried out in two stages.

After brief preoperative preparation, the patient underwent surgery under general anesthesia on the day of admission, when radical full thickness excision of burn wound was performed, reaching the diffuse bleeding margins (escharectomy). Ear amputation was also carried out (Figure 2). The defect was left without immediate reconstruction despite of calvaria exposition. Wet dressing was required twice a day. Wound culture showed mixed gram positive flora. The third generation cephalosporin was parenterally administered as regular regimen. On the fourth day, there was a significant reduction in suppuration and calvarian bones had healthy appearance. The defect size 23×15 cm was reconstructed using the "banana peel" transposition galea-cutaneous flap from the remainder of the scalp, which was based only on the right occipital artery. The galea layer was scored by knife ("fast expanded") using crossed incisions at 2.5 cm distance. The flap was sutured without drainage (Figures 3 and 4). The pericranium at donor site was preserved and the secondary defect skin grafted using the partial thickness skin graft harvested from the left arm. The postoperative course was uneventful. The patient was discharged nine days after the admission when the flap was viable, and skin grafts consolidated. Two months after surgery, the appearance was satisfactory, and all wounds were healed (Figure 5). There was no hearing impairment noted.

Figure 1. Third degree burn of the scalp and ear lobe

Figure 2. Postoperative defect after escharectomy (calvarian bone exposed)

Figure 3. Large pericranial flap on the elevated occipital artery

DISCUSSION

Complex reconstruction of war wounds and heavily infected primary wounds has to be rigorously planned. After the primary surgical debridement and infection control, definitive care is delayed for 3 to 5 days, when delayed primary reconstruction is performed. Modification of surgical management is necessary when certain difficult areas are wounded and when the patient presents after many days or has experienced inappropriate first aid [13]. Our approach to this case was primary debridement and delayed reconstruction.

There are many options for repairing large scalp defects [2, 14]. Primary closure with the adjacent hair-bearing tissue is a suitable choice for the closure of many small scalp defects, less than 3 cm in diameter. But even then, wide undermining of the scalp is usually required. Split-

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Figure 4. Early postoperative result

Figure 5. Delayed postoperative result (frontal view)

thickness or full-thickness skin grafts may be an option for scalp reconstruction when the wound bed is well vascularized. An intact pericranium or fascia is usually sufficient for adequate skin graft "take". When bone is exposed, skin grafts can also be used, but after removal of the outer table of bone using a burr, in order to expose the vascularized diploic space. Disadvantages of this technique include potential skin graft slough and poor esthetic outcome [1, 4, 9, 11]. Tissue expansion can be used to provide additional scalp tissue which would facilitate rotation or advancement flap closure. It is usually performed under elective conditions when immediate, permanent wound coverage is not essential. Tissue expansion is contraindicated when prompt resection and reconstruction of the scalp are required, and there is often loss of hair density using this technique [10, 11]. Local scalp flaps may be used to cover moderate-sized scalp defects. Local scalp flaps usually rely on the extensive undermining and are based on blood supply from the scalp artery or on their combination. The Orticochea tripartite flap and its variants have been used for reconstruction of large central scalp defects [3, 4, 7, 8]. The design of local scalp flaps should incorporate at least one major scalp vessel, although the design of large-scale flaps based on only one artery has been rarely described. In certain situations, galeal scoring may be performed to gain flap length and reduce tension. Galeal scoring should be performed parallel to the subaponeurotic blood vessels, but even more important, the scoring must be perpendicular to the line of maximal tension. Care should be taken not to cut too deeply, as this maneuver can result in flap compromising. The skin graft should be placed over the donor site defect [1, 3, 7, 8, 11]. This concept was beneficial in our case because the recipient site required vascularized tissue coverage and the donor site contained intact periosteum, which was suitable for skin graft coverage. Burow's triangles should not be excised at the time of the initial flap creation to maintain the vascular supply of the flap base. In most patients, the use of regional flaps is precluded due to the limited arc of transposition from the neck and trunk muscles, although the use of these flaps (e.g. trapezius muscle or myocutaneous flap, latissimus dorsi muscle or myocutaneous flap) has been clearly described in literature. Complications of the local flap use are described as follows: partial or total flap loss, infection or seroma formation. The free tissue transfer is advantageous as single stage reconstruction even in previously irradiated or infected tissues, or in the areas with a traumatized bed, where the use of local flaps would not be indicated. Disadvantages of free tissue transfer are a prolongation of the surgical time, high risk of complications (total flap loss, morbidity in the donor zone), and inadequate esthetic appearance (absence of hair flaps). The majority of authors agree that the most commonly used free tissue transfers for scalp reconstruction are radial forearm flap, the latissimus dorsi flap, serratus anterior, rectus abdominis flap, and the omentum flap [4, 14, 15, 16]. The use of free tissue transfer requires expensive equipment and technology, and rate of complications remains high comparing to local flaps. Another subject in our case would be the reconstruction of the ear lobe. Well known procedure is a converse reconstruction using rib cartilage graft and local skin flap, but in our case it was not performed because of patient's age and her refusal to perform such intervention.

Scalp reconstruction based on one artery has to be planned in detail and accurately performed, when possibility of complications is reduced to minimum. We have presented the second look procedure, a scalp reconstruction with the exposed bone, and at the same time the reconstruction of half scalp with the local flap based on one artery.

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Примарно одложена реконструкција великог оштећења поглавине након опекотине режњем у виду коре од банане заснованом на једној артерији

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КРАТАК САДРЖАЈ

Увод Оштећења поглавине и калварије могу настати као последице повреде, опекотина, ресекције бенигних и малигних тумора, инфекција или радионекрозе. Реконструкција великих оштећења поглавине је веома захтеван хируршки захват. Протоколи реконструкције се могу применити код реконструкције оштећења поглавине и калварије.

Приказ болесника Жена стара 68 година примљена је на Клинику за пластичну и реконструктивну хирургију у Нишу због опекотине старе девет дана која је настала под неразјашњеним околностима. Опекотина трећег степена је захватала леву фронтопаријеталну и темпоралну регију и део окципиталне регије, са карбонификацијом целе леве ушне шкољке. Лечење је обављено у две хируршке интервенције. Урађена је радикална некреткомија целе дебљине поглавине, а ивице оштећења киретиране су до активног крварења. Урађена је ампутација ушне шкољке. Оштећење величине 23×15 центиметара реконструисано је транспозиционим галеокутаним режњем преосталог дела поглавине у виду коре од банане, који је заснован само на десној окципиталној артерији. Два месеца након лечења изглед је био задовољавајући, а ране су зарасле.

Закључак Реконструкција поглавине режњем базираним на једној артерији мора се детаљно испланирати и прецизно извести, јер је тада могућност појаве компликација сведена на најмању меру. Приказана је одложена реконструкција половине поглавине са експонираном кости, као и реконструкција половине поглавине локалним режњем заснованим на само једној артерији.

Кључне речи: оштећење поглавине; одложена реконструкција; опекотине трећег степена; окципитална артерија; перикранијални режањ

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